

Water Resources Research



RESEARCH ARTICLE

10.1029/2019WR025011

Key Points:

- About 70% of 2,695 respondents from Murray-Darling jurisdictions support reallocating water from irrigators to Aboriginal communities
- Respondents were willing to pay A \$21.78 in a one-off household levy (aggregate value, A\$74.5 million)
- Results did not reveal strong preferences for how allocated water should be used by Aboriginal communities

Correspondence to:

S. Jackson,

Citation:

Jackson, S., Hatton MacDonald, D., & Bark, R. H. (2019). Public attitudes to inequality in water distribution: Insights from preferences for water reallocation from irrigators to Aboriginal Australians. *Water Resources Research*, 55, 6033–6048. <https://doi.org/10.1029/2019WR025011>

Received 20 FEB 2019

Accepted 30 MAY 2019

Accepted article online 10 JUN 2019

Published online 25 JUL 2019

Public Attitudes to Inequality in Water Distribution: Insights From Preferences for Water Reallocation From Irrigators to Aboriginal Australians

Sue Jackson¹ , Darla Hatton MacDonald² , and Rosalind H. Bark³

¹Australian Rivers Institute, Griffith University, Nathan, Queensland, Australia, ²Tasmanian School of Business & Economics, University of Tasmania, Sandy Bay, Tasmania, Australia, ³School of Environmental Sciences, University of East Anglia, Norwich, UK

Abstract Water allocation regimes that adjudicate between competing uses are in many countries under pressure to adapt to increasing demands, climate-driven shortages, expectations for equity of access, and societal changes in values and priorities. International authorities expound standards for national allocation regimes that include robust processes for addressing the needs of “new entrants” and for varying existing entitlements within sustainable limits. The claims of Indigenous peoples to water represents a newly recognized set of rights and interests that will test the ability of allocation regimes to address the global water governance goal of equity. No study has sought to identify public attitudes or willingness to pay for a fairer allocation of water rights between Indigenous and non-Indigenous people. We surveyed households from the jurisdictions of Australia’s Murray-Darling Basin, a region undergoing a historic government-led recovery of water, and found that 69.2% of respondents support the principle of reallocating a small amount of water from irrigators to Aboriginal people via the water market. Using contingent valuation, we estimated households are willing to pay A\$21.78 in a one-off levy. The aggregate value calculated for households in the basin’s jurisdictions was A\$74.5 million, which is almost double a recent government commitment to fund the acquisition of entitlements for Aboriginal nations of this basin. Results varied by state of residency and affinity with environmental groups. An information treatment that presented narrative accounts from Aboriginal people influenced the results. Insights from this study can inform water reallocation processes.

1. Introduction

The allocation of water between competing uses is an urgent issue in many countries as governments and water user groups respond to one of humanity’s most significant challenges and seek to reconcile ever-increasing demands for water with finite supplies. Authorities in many river basins have stopped issuing new entitlements and are attempting to divert less water to human uses (Cosgrove & Loucks, 2015; Wheeler et al., 2017). When current rates of extraction are the principal cause of contestation and environmental degradation (Grafton & Horne, 2014), finding ways of reducing diversion levels and sharing water entitlements presents new challenges for water allocation regimes to adapt to change. Adjudicating between uses and users is controversial because of inequities in access and the existence of polarized positions regarding community and environmental welfare (Wheeler et al., 2017; Whiteley et al., 2008).

As the largest user of water worldwide, irrigation is often at the center of intersectoral water allocation debates. Irrigation is targeted for water savings because it provides “the most immediate opportunity for real-locating some water to other water uses or sectors as demand grows” (Cullet, 2018, p. 330). Attempts to examine what drives the behavior of powerful water-using groups, such as irrigators, and broader public preferences on the acceptability of the costs and benefits of water-sharing mechanisms have risen as a response to this water reallocation problem (see Bjornlund et al., 2014; Loch et al., 2014; Wheeler et al., 2017). Thus, there are now many studies of attitudes toward and preferences for reallocating water from irrigated agriculture to other uses, particularly the environment (Graham, 2009; Wheeler et al., 2013).

Even when proposals for reform appear to be beneficial, reallocating water between groups that are each vying for their “fair share” will create difficult policy choices (Syme et al., 1999). The contested nature of water allocation has focused scholarly analysis on the appropriate value bases upon which public and private actors should make decisions affecting distributions. Studies have reached beyond consideration of costs and

©2019. The Authors.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

benefits to encompass ethical and moral dimensions, generating insights into public attitudes toward fairness and equity in water rights distributions and priorities and processes for sharing water and decision-making power (see Schmidt & Peppard, 2014; Syme et al., 1999; Syme & Nancarrow, 1996; Wilder & Ingram, 2018; Wutich et al., 2013). Yet the global water management sector, guided by the principles of integrated water resource management, continues to pursue efficiency as its over-arching goal, rather than equity (Cullet, 2018). Despite decades of international effort, “equity related problems persist and in many cases worsen” (Wilder & Ingram, 2018, p. 49).

With widespread agreement that water equity must be prioritized in water governance (Whiteley et al., 2008; Wilder & Ingram, 2018), justice concepts have emerged as frameworks for explaining skewed distributions and uneven rates of participation in decision-making affecting water (Conca & Weinthal, 2018; Jackson, 2018a; Neal et al., 2014; Whiteley et al., 2008; Wutich et al., 2013; Zwarteveen & Boelens, 2014). This is especially so in situations of resource scarcity, where justice becomes “more salient” in national policy and public discourse (Clayton, 2000, p. 459). In South Africa, for example, since the end of apartheid, the legislature has responded to debates on water justice from a human rights perspective and procedures to redistribute water are now part of the nation’s governance framework (Van Koppen & Schreiner, 2014). In Australia, where a severe drought triggered a water crisis, studies show people want to see outcomes from water rights contests that are just, fair, and equitable (Lukasiewicz et al., 2013; Nikolakis et al., 2013). More generally, the adoption and promotion of water markets in many countries has brought social justice issues to the fore because of the purported negative effects of power asymmetries on the water holdings of the poor (Hadjigeorgalis, 2008). In Chile, the government has developed an Indigenous Land and Water Fund to finance the acquisition of water use rights for Indigenous landholders, a move that both responds to and utilizes market mechanisms of allocation to redress the “unfair distribution” of water produced by the neoliberal water reform of the 1980s (Macpherson, 2017, p. 1138).

In this paper, we examine a particularly acute form of water injustice experienced by Indigenous peoples. Indigenous peoples constitute an especially neglected and vulnerable group that confronts exclusion from water allocations amidst continually expanding demands for water (Jackson, 2018a). Water allocation regimes are strongly conditioned by historical rights of access and usage patterns (OECD, 2015) that did not recognize or respect Indigenous water rights, and these institutionalized patterns have proved difficult to change. Allocation regimes in the United States, Canada, Australia, and New Zealand, for example, excluded Indigenous peoples and prioritized the interests and water needs of “settler” communities (Berry et al., 2017; Tarlock, 2010). Outstanding and newly articulated water rights claims from Indigenous peoples therefore present a clear equity challenge to today’s water allocation systems (see Bark et al., 2012; Budd, 2009; Trawick, 2003; Womble et al., 2018). The United Nations Declaration on the Rights of Indigenous Peoples, for example, establishes norms of water justice that encompass water rights (Robison et al., 2018; UN General Assembly, 2007).

Here we seek to ascertain public attitudes to reallocating water from irrigators to Aboriginal communities of the Murray-Darling Basin (MDB) of Australia. In the MDB there are over 40 Aboriginal nations seeking to gain water rights. The region is often presented as an exemplar of water policy innovation for government commitments to reset the balance between environmental and consumptive use of water, primarily extracted for irrigation (Wheeler et al., 2017). Governments capped water diversions under a series of reforms spanning more than two decades, and markets and trading arrangements have facilitated voluntary reallocation from and within the irrigation sector. Australian legal frameworks for water management currently offer Aboriginal peoples’ limited protection of their water rights (Jackson & Langton, 2012; McAvoy, 2008; O’Bryan, 2019; Tan & Jackson, 2013). Water law and policy narrowly prescribes Aboriginal rights, and they contain no substantive restitution measures to redress the historical pattern of exclusion from the water economy. The development of tradeable water rights decoupled from land titles has not redressed this significant water justice challenge. Furthermore, improvement in consultation between federal and state governments and Aboriginal organizations during this era of water reform has not yet increased the volume of water that Aboriginal peoples have under their control.

There is no shortage of policy-related studies of the means of reallocating water to Indigenous peoples, particularly from the United States, Canada, Australia, and New Zealand, where pathways to reallocation include reserved rights, government acquisition of entitlements, or negotiated settlements (Colby et al.,

1991; Durette, 2010; Jackson, 2018b; Macpherson, 2017; Tarlock, 2010). However, no study has sought to understand public attitudes to reallocating water to Indigenous peoples from existing water rights holders. Attitudinal studies of water sharing focus on the distribution of water among current users (see, for example, Thorvaldson et al., 2010; Wheeler et al., 2013). Such studies overlook the needs of Indigenous peoples whose unique claims have long been unrecognized or ignored but are now gaining legitimacy. Attitudinal studies of fairness in water allocation do not tend to consider this dimension either (Lukasiewicz et al., 2013; Syme & Nancarrow, 1996). Nikolakis et al. (2013) conducted a survey of Aboriginal and non-Aboriginal peoples' attitudes to water markets in north Australia; however, only individuals with expertise in, or awareness of, water reform and markets were surveyed. In that study, the authors concluded that "Indigenous respondents do not agree that the current water management regime is equitable; nor do they believe it reflects their interests" (Nikolakis et al., 2013, p. 17). Of the few nonmarket valuation studies relating to Indigenous resource management, the focus has been on willingness to pay (WTP) for environmental services delivered by or for Indigenous people (Zander et al., 2010; Zander & Garnett, 2011), rather than intersectoral transfer of a resource right like a water entitlement. In the context of this paper, securing a right to access water for a previously unrecognized group, such as Aboriginal Australians, in a "closed" resource pool requires that another user forego use of an equivalent amount.

Understanding policy preferences for sharing water with Indigenous peoples is of importance to policy makers, Indigenous organizations and communities, legislators, water agencies, and the public. Political action directed toward change in state-based water allocation institutions is a key focus for Indigenous peoples engaged in water rights struggles (Jackson, 2018b; Taylor et al., 2017). Knowledge of how particular groups in society perceive the relative water needs of Indigenous people, the environment and agricultural sector, and what policy options are likely to be acceptable, or least socially contentious, can inform policy and could guide future reforms to allocation regimes, as well as awareness-raising programs by policy leaders.

According to Bjornlund et al. (2014), attempts to introduce water-sharing policies are often met with opposition, especially from the irrigation sector, but also from other sectors of society. For instance, the debate over water in Australia remains highly polarized to this day: the current plan to reallocate water from irrigators to the environment is one of Australia's most controversial water policies ever implemented (Wheeler et al., 2017). Amidst this background, federal and state governments are now considering purchasing water for Aboriginal peoples. When deciding how to share water more equitably, decision makers will have to evaluate and weigh various perspectives, interests, and outcomes, and few will want to revisit past decisions without evidence.

For over a decade Aboriginal advocates and researchers have advanced a market-based reallocation mechanism as a means of addressing the disparity in water rights distributions between Indigenous and non-Indigenous people (McAvoy, 2008; Taylor et al., 2017). One of our aims in this study is to determine whether there is public support for reallocation via the water market. The second aim is to use contingent valuation to estimate the WTP for two different payment vehicles—a levy on water bills and government expenditure—for such a reallocation. Finally, we ascertain preferences for different types of water use for beneficiary Aboriginal communities. Results from our study show firm support for the principle of reallocating a small volume of water from irrigators to Aboriginal people, no strong preferences to restrict water use to cultural and environmental uses, and aggregate WTP of a magnitude that exceeds current government commitments.

The structure of the remainder of the paper is as follows: We describe the case study context, outline the study design, present the empirical results, then discuss the policy implications of our results and offer some concluding remarks.

2. Case Study: The MDB

The international water policy community views Australia as a leader in water reform, particularly in the use of markets to achieve water use efficiencies and reallocate water to the environment (Grafton & Wheeler, 2018). Successive national reforms have focused on the MDB, which occupies one seventh of the continent ($1.06 \times 10^6 \text{ km}^2$) and is its most productive agricultural region. The MDB drains waters from four states (New South Wales [NSW], Victoria, Queensland, and South Australia) and the Australian Capital Territory (ACT; see Figure 1). It contains important groundwater systems and more than 20 major rivers

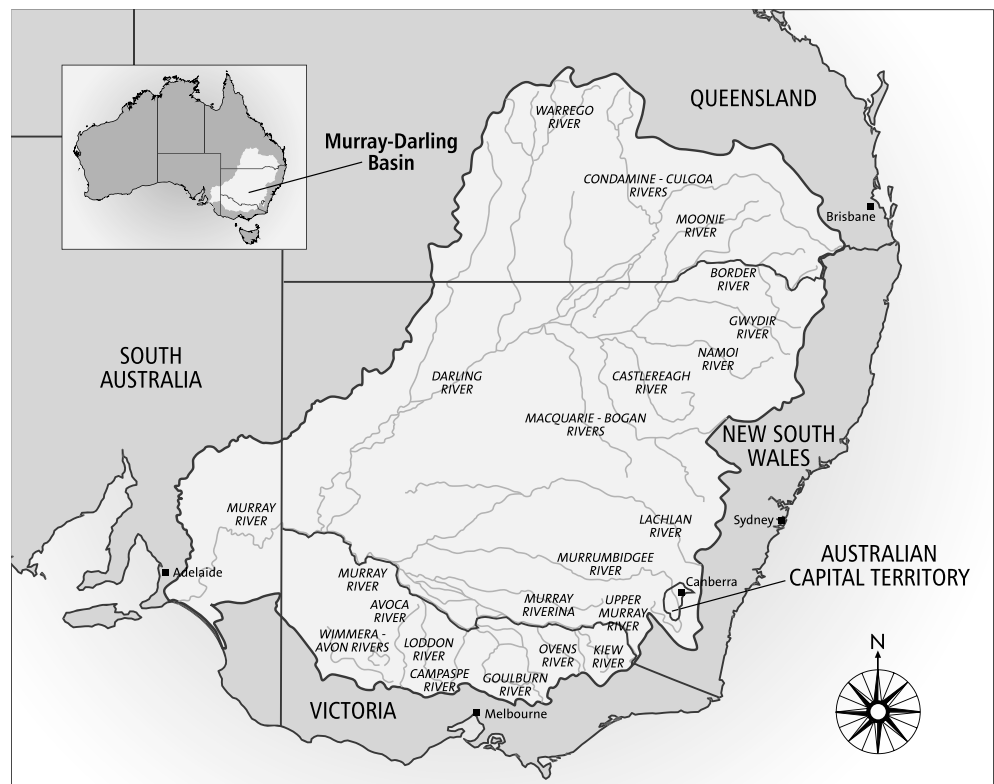


Figure 1. Map of the Murray Darling Basin.

linking 23 catchments and 30,000 contiguous wetlands, most of which are dependent on water for which there is intense competition from agricultural production (Alexandra, 2018). It supports approximately 40% of the total gross value of Australia's agricultural production, including 46% (A\$7 billion) of the gross value of irrigated agriculture (Productivity Commission, 2018).

Irrigated agriculture has, typically, accounted for approximately 70% of water diversions and is responsible for ~90% of the water consumed in the basin (Grafton & Wheeler, 2018). In addition, the 2.1 million people that reside within the basin draw their water supply from its waters, as do a further 1.3 million people who live outside its limits (Productivity Commission, 2018). Of the total water used for consumptive purposes, households consumed about 6% in 2010, mining less than 1%, manufacturing and other industries about 4%, and stock animals a small but unquantified amount.

The basin encompasses the territories of more than 40 autonomous Aboriginal nations that comprise approximately 15% of Australia's Aboriginal and Torres Strait Islander population (Robison et al., 2018). In 2016, the Wentworth Group of Concerned Scientists (2017) estimated that the Aboriginal population was 4.4% of the MDB total and was growing at a rate nearly 4 times the rate of its overall population. Like Aboriginal peoples in other regions of Australia, basin communities experience significant socioeconomic disadvantage in almost all measures of well-being. For example, labor force participation of the Aboriginal community in 2016 (54%) was less than the MDB average (64%; Wentworth Group of Concerned Scientists, 2017).

Colonial law did not originally recognize Aboriginal occupation, and so, as landless people, Aboriginal communities were not entitled to exercise riparian rights or to access water licenses under state systems of administration (Berry & Jackson, 2018). The development of the basin left Aboriginal nations in possession of less than 1% of its land base, representing a higher level of dispossession than many other Australian regions (Arthur, 2010). In addition to the social impacts for Aboriginal communities (Taylor et al., 2017; Weir, 2009), surface water extractions for irrigated agriculture imposed large environmental costs (Grafton & Horne, 2014), with over-allocation of water contributing to the degradation of water-dependent ecosystems. In 2010, a major river sustainability audit classified 20 of the basin's 23 river valleys as in either a poor or very poor state of ecological health (cited in Alexandra, 2018). The latest State of the Environment

Report (Argent, 2017) shows little improvement. Until recently, few of the basin's rivers and their floodplains, which have high conservation value and are of cultural significance, have had secure water supplies, and climate models predict a decline in future inflows (Alexandra, 2018).

A severe drought that diminished flows in the River Murray during the first decade of this century catalyzed action to secure environmental water supplies (Wheeler et al., 2014). The federal government passed legislation to improve the health of the basin's ecosystems by setting sustainable diversion limits and developing a Basin Plan to oversee recovery of water for the environment. By mid-2019, the average annual level of water extraction is to be reduced by 2,750 Gt/year, or about 25% relative to long-term historical diversions with an additional 450 Gt by 2024 (Grafton, 2019).

To date the Australian Government has spent \$2.5 billion on purchasing irrigation water entitlements and \$6 billion on infrastructure to improve irrigation efficiency and delivery of environmental water (Grafton & Wheeler, 2018). This represents the world's biggest buyback of water rights, and the reduction in irrigated agriculture's share has been strenuously opposed by some irrigators. The effects of water sales are hotly contested with community concerns around farm exit, population decline, and reduced social services, gross regional product, and job availability (Wheeler et al., 2014).

Notwithstanding the historic shift in water governance from a focus on water extraction to a more complex set of social, economic, and environmental objectives, equity is not a topic that has received very much attention by Australian water researchers (Lukasiewicz et al., 2013; Nikolakis et al., 2013). In particular, the needs of Aboriginal communities to access water has been a marginal consideration for policy makers, relative to the attention given to ecosystem degradation and restoration, as well as to structural adjustments and the vitality of irrigation communities (Bark et al., 2015; Jackson, 2017; Nikolakis et al., 2013; Weir, 2009). Under Australian law, native title does not include ownership of natural waters and the rights recognized are limited to "traditional and cultural" rights that resemble precolonial water interests (Macpherson, 2017). They are not tradeable and are vulnerable to extinguishment if "other right holders have, since colonisation, acquired inconsistent rights" (Macpherson, 2017, p. 1131). Furthermore, governments are not required to gain consent from or to negotiate with native title-holders before granting a right to take water (Tan & Jackson, 2013).

Aboriginal people are greatly constrained in their ability to gain access to water and benefit from the water economy, and environmental water programs and policies are only beginning to take account of their perspectives (Jackson & Langton, 2012; O'Bryan, 2019). In response to Aboriginal claims for "cultural flows" (Taylor et al., 2017), federal and state governments have more recently shown interest in mechanisms to improve Aboriginal access to water (Jackson, 2017). Cultural flows are defined by a representative Aboriginal organization as "water entitlements that are legally and beneficially owned by Indigenous Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations" (cited in Taylor et al., 2017, p. 6). Market instruments may constitute a promising policy approach, especially in the absence of strong legal protections. Appeals to state and federal governments to finance the purchase of water entitlements for Aboriginal people have met with some recent success. In 2018 the federal government established a A\$40 million program to purchase water entitlements for cultural and economic uses for MDB Aboriginal communities (Productivity Commission, 2018).

3. Methods

3.1. Questionnaire Design

We designed a questionnaire to explore priorities and preferences for different uses of water among respondents in the four MDB states and the ACT. The multipart online questionnaire first outlined the purpose of the research, as required to demonstrate informed consent (ethics approval HREC 2015/470 and H0016811). It then posed questions on the importance of different public policy issues in Australia, familiarity with the MDB, the Millennium Drought (1997–2009), and the water policy debate surrounding the drought. Respondents were then randomly assigned to one of six different experimental treatment conditions (Condition 1, 2, ..., 6, hereafter) to explore stated preferences for water reallocation. The questionnaire then proceeded to attitudes to procedural fairness, proximity to different water-using groups, and general

sociodemographic questions. In this paper, we focus on levels of support for reallocating water in the MDB from irrigators to Aboriginal communities.

We framed questions about levels of support for reallocating a small amount of irrigation water given different cost implications and the provision of contextual information. Conditions 1 and 4 ask respondents about their willingness to support a percentage of irrigation water being reallocated to Aboriginal communities. The framing of the question of support is general, and no cost is mentioned. Conditions 2 and 5 ask the same question but with a cost to the Commonwealth government (referring to Australia's national or federal government). Conditions 3 and 6 ask respondents their WTP to support a specific percentage of irrigation water (5% of irrigation water or approximately 300 GL) being reallocated to Aboriginal communities with a cost to their household in the form of a levy on their 2018 water bill. For each condition pair (1 and 4, 2 and 5, and 3 and 6), Conditions 4, 5, and 6 provide respondents with additional information in the form of two quotes from Aboriginal community leaders on the value of water for cultural practices and employment (see Box 1). The two quotes were included to give voice to the concerns of Aboriginal people and to test whether these short testimonies would influence responses.

In Conditions 3 and 6, we used a contingent valuation survey to estimate WTP. This method provides respondents with a scenario and a cost and asks them to make a choice, often framed as a vote in a referendum (Boyle, 2017). We selected it from other stated preference methods because the single scenario is cognitively easier for respondents when compared with the sequences of multi-attribute choice tasks characteristic of a discrete choice experiment. This is important because the topic is likely somewhat unfamiliar for many Australians. The method also provides lower and more conservative results (Morrison & Hill, 2017).

Box 1

Restoring access to water is important for the social and cultural well-being of Aboriginal people in the Murray-Darling Basin. Aboriginal people have said that:

"Watering the environment maintains our cultural practices. For example, when there is water at the Fish Traps in Brewarrina our people gather there — old people, families and children — to swim, to catch fish and walk in the footsteps of ancestors at the traps. This is all a part of our cultural education which is about connectivity between all things in Country and our people. It is a holistic way of understanding waterways and all life. When there is water in the environment this way of understanding is clear to us".



Fish trap Photo credit: B. Moggridge

Restoring access to water to Aboriginal traditional owners can increase employment opportunities in Aboriginal communities, especially for young people. Aboriginal leaders have said:

"... little progress has been made in the allocation or licensing of water for Indigenous economic purposes. The challenges faced by Indigenous people in seeking to develop water-dependent businesses and enterprises is illustrated by the fact that while Indigenous people own almost 20% of the country's land mass, Indigenous-specific water entitlements are estimated at less than 0.01 per cent of Australian water diversions."

To date, water reform is framed in oppositional terms: environment versus production (Lukasiewicz et al., 2013). This framing overlooks the multiplicity of diverse and interrelated water values held by Aboriginal

peoples (Jackson, 2017; Taylor et al., 2017; Weir, 2009). To test this duality with respect to Aboriginal water uses, we asked those respondents assigned to Conditions 3 and 6 who voted “Yes” to a levy amount what proportion of the water should be used by Aboriginal communities for (a) environmental and cultural purposes and (b) agricultural businesses. Our hypothesis, which could limit the aspirations of Aboriginal people to apply water to multiple purposes and to develop water-based livelihoods, was that there would be more support for environmental and cultural uses than for use in commercial enterprises.

3.2. Elicitation Question

To avoid the potential for “yea-saying” (Blamey et al., 1999), we used a dissonance minimization approach (Blamey et al., 1999; Morrison & Hill, 2017). This is particularly relevant in new policy areas where respondents have little prior experience of indicating their preferences. We also considered it well suited to this study’s context because of the unresolved tensions between the Australian settler nation and Aboriginal peoples. In light of evidence of an “often confused and conflicting direction of public attitudes towards Indigenous people” (Walter, 2012, p. 15), we anticipated that some respondents may vote Yes rather than answer “No” for fear of being perceived by researchers as racially discriminatory (despite answering anonymously). Dissonance minimization offered a more nuanced set of responses to the reallocation question (see Box 2). The upper bound of the one-off levy amount was conservatively set at \$100.

We refer to these supportive but unwilling to pay choices as “supportive-no” votes (s-NO1 to s-NO4 in Box 2), where s-NO is defined as “supporting the goal of reallocating water to Aboriginal communities but voting no to pay for such an outcome.”

Box 2

If you had to vote in a referendum today, would you support 5% of the average amount of water used by irrigators in the Murray-Darling Basin in a year (about 300 Gegalitres) being bought from willing sellers in the water market and then allocated to Aboriginal people? The cost would be paid by a one-off levy of \$X (a randomly assigned amount from \$25 to \$100 in \$5 increments) on one water bill of every Australian household in 2018. If you rent, the levy will be passed along in the form of increased rent.

- I would vote YES to the proposal of paying a one-off levy of \$X on water bills to buy 300 Gegalitres of water for Aboriginal people
- I support the goal of allocating water to Aboriginal people but it is not worth \$X to me and thus vote NO (s-NO1)
- I support the goal of allocating water to Aboriginal people but I cannot afford a one off levy of \$X and thus vote NO (s-NO2)
- I support the goal of allocating water to Aboriginal people but I would prefer to save my money and give to another cause and thus vote NO (s-NO3)
- I support the goal of allocating water to Aboriginal people but I object to any increase in levies and thus vote NO (s-NO4)
- I would vote NO because I am opposed to this proposal

3.3. Focus Group Pretesting

The questionnaire design and language was tested with a focus group of six people (range of ages, male/female, and employment backgrounds) in Melbourne in 2017. Focus group discussion refined the questionnaire wording and was used to test the acceptability of the one-off levy amounts with participants largely refusing at \$100. In September 2017, we conducted an online pretest of 59 respondents. The pretest data were aggregated into the final data set because only minimal changes were made and little time had lapsed between the pretest and the final survey.

3.4. Survey Sample

In the period November to December 2017, an online survey collected data for this study. One of the largest internet panel providers in Australia, the Online Research Unit (<http://theoru.com/panels.htm>), sent 28,500 invitations to potential adult respondents randomly drawn from a sampling frame stratified by age, gender, and state/territory. Incentives used for survey completion included airline points and gift cards.

4. Results

4.1. Sample Characteristics

Following two reminders, 2,699 people completed the questionnaire (four responses were blocked from the support question, as quotas were full). The response rate was 9.5%. Summary statistics are provided in Table 1.

Our sample reflects the Australian population in terms of gender, age cohorts (reflecting proportions 18+) and household size. Only 15 people identified as Aboriginal or Torres Strait Islander, representing less than the Indigenous proportion of the national population (3%) (Australian Institute of Health and Welfare, 2017). The sample is more educated with 35% holding a bachelor's degree or higher compared with 31.4% of working age Australians (ABS, 2018a, 2018b) and has marginally lower household income (note only 2015–2016 ABS income data available for comparison).

Almost 30% of respondents live or have lived within the MDB. Many had visited and undertaken recreational activities, some of which were nature based. For example, 26.2% reported having camped, 18.4% gone swimming, and 15.5% having fished in the MDB. Half the respondents reported that the Millennium Drought (1997–2009) had affected their household. Almost half (48.1%) remembered the public debate surrounding the MDB water-sharing plan, whereas 48.4% did not.

4.2. Levels of Support for Water Reallocation to Aboriginal People

In Condition 1, where the amount of irrigation water purchased from willing sellers varied from 1% to 5% of the irrigation total, 44.9% of the sample supported reallocation to Aboriginal communities (see Table 2). In Condition 2, with the inclusion of a cost to the Commonwealth government, support for reallocation decreased to 30.8%. In Condition 3, the amount of water purchased was fixed at 5% of irrigation water and the cost was articulated as a household levy. Furthermore, dissonance minimization allowed participants to provide a more nuanced response indicating support for the concept while also giving a rationale for not paying. Explicit support decreased to 21.8%. The proportion that indicated explicit support (Yes) and s-NO was 71.9%.

The addition of information resulted in no statistically significant differences between Condition 1 and Condition 4 ($p = 0.74$) nor between Condition 2 and Condition 5 ($p = 0.21$), but some evidence of difference between Condition 3 and Condition 6 ($p = 0.06$). Those who voted Yes to Condition 3 (and 6) were asked to indicate a preferred use for the water allocated to Aboriginal people. Of the respondents voting Yes, 17.9% (38.4%) preferred that a greater share be directed to Aboriginal environmental and cultural purposes, 43.5% (37.9%) for the water to be split evenly between environmental/cultural use and agricultural businesses run by Aboriginal communities, and 38.6% (23.6%) for a greater share to be directed to agricultural businesses.

4.3. Regression Results for WTP

Binary logit models were used in the analysis of the data from Conditions 3 and 6. We present four models in Table 3. In Models 1 (Condition 3) and 2 (Condition 6), the votes are coded as Yes = 1 and all No and s-NO = 0. In Model 1, the levy amount is statistically significant indicating that the probability of voting Yes decreases as the levy amount increases. In Model 2 it is insignificant, suggesting that when the choice is framed with quotes from Aboriginal leaders, the dollar amount of the levy had no effect on choice. In Models 3 and 4 only the Yes and the No responses are retained; that is, we drop all s-NO responses. The coefficient for levy is negative and significant in Model 3 (Condition 3), but in Model 4 (Condition 6), the levy amount has no effect on choice.

Sociodemographic variables such as age and gender were included in the logistic regressions with mixed results across the coding of choices. As household income was collected via checkbox categories, a binary variable was created for household income less than \$800 per week (average household income was \$1,438 per week in 2017). Low income status is significant and negative in Models 2 and 4 suggesting that low income households are less likely to vote Yes for reallocating water. A binary variable, indicating close and very close social proximity to environmental or conservation groups, was positive and significant in all four models; that is, respondents are more likely to vote Yes to the WTP scenario.

Table 1
Sample Means for Respondents' Sociodemographic Characteristics

Sociodemographic characteristics	Number	Proportion (%)
Demographics		
Female	1,370	50.8
Mean age (median)	48.3 (47 years)	
Household size (median)	2.65 (2 people)	
Aboriginal and Torres Strait Islander	15	0.5
Education		
Year 9 or below	54	2.0
Year 10	219	8.1
Year 12	385	14.3
Certification/diploma/TAFE	850	31.5
Bachelor degree	708	26.2
Graduate Diploma/Masters	183	6.8
PhD	54	2.0
Income		
Under \$31,149	561	20.8
\$31,150 to \$64,949	749	27.8
\$64,950 to \$129,949	882	32.7
Above \$129,949	507	18.8

Note. In Australia, technical and further education or TAFE institutions provide a wide range of predominantly vocational courses.

It is not possible to estimate reliably WTP directly from the regression results in Table 3 because the proportion of Yes responses is low ("fat-tails" problem (Haab & McConnell, 2002)). The insignificant estimated coefficient on levy further exacerbates the problem (with the exception of Model 3). We therefore use a Turnbull estimator, which is a distribution-free approach described in Haab and McConnell (2002). It uses a smoothing estimator to establish the minimum WTP for nonnegative WTP distributions. Table 4 provides these WTP estimates for Conditions 3 and 6 by state arranged from upstream to downstream then the ACT and for the whole sample.

Table 2
Levels of Support for Water Reallocation to Aboriginal Communities by Paired Conditions, Number, and Percent

Response	Number	%	Number	%
	Condition 1		Condition 4	
Yes	48	44.9	51	49.5
No	30	28.0	26	25.2
Don't know	29	27.1	26	25.2
Total	107		103	
	Condition 2		Condition 5	
Yes	32	30.8	33	32.7
No	35	33.7	43	42.6
Don't know	37	35.6	25	24.8
Total	104		101	
	Condition 3		Condition 6	
Yes	246	21.8	272	23.7
s-NO1	105	9.3	130	11.3
s-NO2	151	13.4	161	14.0
s-NO3	65	5.8	75	6.5
s-NO4	245	21.7	252	21.9
No	318	28.1	260	22.6
Total	1,130		1,150	

To calculate the aggregate WTP value, we used the Turnbull lower bound estimators for Condition 3 whole sample and an estimate of the number of households in the MDB jurisdictions using 2016 Census data on family characteristics (ABS, 2018a, 2018b). Treatment of response rates (9.5% for this study) varies in the literature, so we present a range of values. If it is assumed that all survey nonrespondents have zero WTP, then extrapolating to the population of households, the aggregate WTP is A\$17.0 million. Conversely, assuming that all nonrespondents have identical preferences to the sample, then extrapolation results in an aggregate value of A\$179.6 million. These approaches have been criticized as being overly conservative or potentially biased upward, respectively. As the invitation and informed consent description referenced social values associated with water, it may be safe to assume that a portion of the invitations were unopened due to time constraints rather than opposition to water reallocation to Aboriginal people. Applying this logic and the adjustment in Morrison (2000), we assume that 32% of respondents had similar preferences as our sample and did not respond to the survey because of time constraints rather than opposition to water issues, providing an aggregate WTP value of A\$74.5 million.

5. Discussion and Implications

While there have been various studies identifying the market and nonmarket value of water in the MDB (Bark et al., 2014, 2015;

Table 3
Condition 3 and Condition 6 Regression Results

Variables above constant	All responses—s-NO coded as No				All s-NO responses removed			
	Model 1 (Condition 3)		Model 2 (Condition 6)		Model 3 (Condition 3)		Model 4 (Condition 6)	
	Estimated coefficient (standard error)	p value	Estimated coefficient (standard error)	p value	Estimated coefficient (standard error)	p value	Estimated coefficient (standard error)	p value
Constant	−0.525 (0.305)	0.085*	−1.026 (0.302)	0.001***	1.136 (0.393)	0.004***	0.525 (0.396)	0.185
Levy	−0.009 (0.003)	0.006**	−0.005 (0.00301)	0.120	−0.009 (0.004)	0.017**	−0.006 (0.004)	0.120
Age	−0.009 (0.005)	0.046**	−0.001 (0.005)	0.912	−0.025 (0.006)	0.000***	−0.011 (0.006)	0.059*
Gender (1 = female)	−0.062 (0.147)	0.674	0.092 (0.142)	0.518	0.206 (0.182)	0.257	0.564 (0.182)	0.002***
Low household income (1 = \$48,548 or less)	−0.101 (0.166)	0.544	−0.408 (0.164)	0.013**	−0.227 (0.199)	0.252	−0.354 (0.206)	0.085*
Close to environmental or conservation groups	0.802 (0.151)	0.000***	0.669 (0.145)	0.000***	1.252 (0.198)	0.000***	0.810 (0.193)	0.000***
Number of respondents	1,130		1,150		564		532	
Log-likelihood	−572.36		−614.25		−351.616		−349.06	
Pseudo- R^2	0.033		0.024		0.090		0.053	

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Raymond et al., 2009), no previous studies have investigated public support for improving access to water for Aboriginal people. Understanding equity implications is an important aspect of water policy, and previous studies have investigated the effects on the irrigation sector and regional towns of redistributing water entitlements through water trading (Wittwer, 2011; Wittwer & Griffith, 2011). Yet there have been no attempts to estimate the WTP of the public to reallocate water to Aboriginal people via a market mechanism or any other. Therefore, we present the results of a contingent valuation study that asked respondents in MDB jurisdictions their WTP for the reallocation of water from irrigation to Aboriginal communities.

There are no benchmarks for public attitudes toward reallocating water to Aboriginal peoples. We can however assess the results in the context of general attitudes to Indigenous Australians and attitudes to other redistributive measures, such as land rights restoration and government assistance. There is a considerable body of research indicating that many Australians have negative attitudes toward Indigenous Australians (Forrest & Dunn, 2006; Griffiths & Pederson, 2009; Pederson et al., 2005; Zander & Garnett, 2011). Such attitudes can include the view that Indigenous people are undeserving of government assistance or that they receive too much assistance. Drawing on results from the annual Australian Social Survey that in 2007 asked questions about Indigenous disadvantage, racial segregation, and restorative measures, Walter (2012) found that only 9% strongly agreed and 36% agreed (45% in total) that Indigenous disadvantage justifies extra government assistance. Furthermore, a strong majority (66%) agreed that granting land rights to Indigenous people is unfair, even though the majority agreed that Indigenous Australians are not treated equally and that injustices are not all in the past. The author concluded that there is a dissonance between egalitarian attitudes and willingness to support action to address inequality:

... a small majority of non-Indigenous Australians tends to hold egalitarian belief systems about Aboriginal people's position in society, but, incongruously, these do not extend to the restorative actions of land rights or extra government assistance (Walter, 2012, p. 27).

That survey did not ask respondents to pay to attain any specific costed restorative outcome, whereas in our survey, we assigned respondents to one of three conditions, no cost attached, cost attached to the federal government, and a cost attached to the household. A clear and consistent pattern emerges across all paired conditions. Support for reallocation was

Table 4
Estimated WTP (Turnbull lower bound) per Household for Conditions 3 and 6, for the Whole Sample and by State, A\$

State	Condition 3	Condition 6
	WTP estimate	WTP estimate
Queensland	17.00	18.93
New South Wales	22.35	14.71
Victoria	21.81	15.21
South Australia	16.80	14.14
Australian Capital Territory	20.00	25.13
Whole sample	21.78	22.28

Note. WTP willingness to pay.

highest when there was no cost attached (i.e., 44.9% and 49.5% for Conditions 1 and 4), reduced when the cost was born by the government (i.e., 30.8% and 32.7% for Conditions 2 and 5), and lowest when the cost was borne through a household levy (21.8% and 23.7% for Conditions 3 and 6).

Venn and Quiggin (2007, p. 340) argue that “there are strong ethical grounds for accommodating or compensating for extinguished Indigenous water rights.” Although our survey did not seek to ascertain public views on compensation for extinguished or expropriated water rights, it is possible that such an ethical consideration might have motivated WTP and further research could confirm or counter this conjecture. A related point is the results pertaining to outright opposition to the notion of reallocating water. For those respondents asked to pay a household levy, outright opposition was 28.1% (Condition 3), and this declined to 22.6% when we provided respondents with additional information (Condition 6).

There is some evidence that information provision increased levels of support between Conditions 3 and 6 ($p = 0.06$). Information was in the form of direct quotes from Aboriginal people. The inclusion of a narrative in the first person can illustrate the benefit(s) of increased water allocations and trigger a more empathetic response. The Australian Psychological Association (1997, p.9) found stories have an “immediacy and credibility” in providing insight into the subjective experience of a racialized minority like Aboriginal peoples. In a survey not about distributive justice but about procedural fairness regarding native title rights, Peate et al. (2008) found that respondents regarded Indigenous voice only to be fairer than non-Indigenous voice only. This finding will be of specific interest to scholars of water justice who suggest that understandings of justice need to be anchored in how injustices are *experienced*, rather than based on abstract norms (Zwarteveen & Boelens, 2014, p. 147). Nevertheless, in our study information that conveyed an Indigenous perspective did not have a universally positive effect on the amount respondents were willing to pay across the jurisdictions surveyed (see Table 4). In three states (NSW, Victoria, and South Australia), the WTP was lower in Condition 6, suggesting that the effect of Indigenous voice and the type and levels of information on responses to reallocation is also a worthy topic for further research.

In terms of other variables modeled in a different context, Mueller et al. (2019), using a choice model, estimated the WTP (a single payment on a water bill) of different attributes of forest restoration targeted to improve the health of a semiarid watershed. Respondents to their survey were Phoenix, USA, residents who rely on the Salt Verde River watershed to meet their water demands. One of the attributes estimated was “cultural significance,” which was represented as restoration projects targeted at areas of cultural significance to Native Americans. Like in our study, the cultural importance of water was defined broadly, namely as “any area of the watershed referred to directly in oral histories, used in ceremonies, or serving as primary water sources for an Indigenous Nation” (Mueller et al., 2019, p. 82). The WTP for cultural significance estimated by the authors was US\$23.33 per household. In an Australian study, Zander et al. (2010) found that people living in southern Australian cities were willing to pay substantial amounts of money to maintain the “cultural values” of tropical Australian rivers (defined as the condition of waterholes important to Aboriginal people). In that study, respondents did not perceive income from irrigated agriculture as very important. Also in Australia, Zander (2013) found 58% of respondents were willing to pay for Aboriginal natural resource management in the country’s north. Southern Australians, women, and those with an interest in Aboriginal societies (64%, 66%, and 71%, respectively) had higher WTP values, and, when asked about their reasons, 75% chose “Maintain Aboriginal culture” and 65% “Contribution to job creation for Aboriginal people.” Whereas in our study, the results pertaining to age and gender were mixed. According to Walter (2012 p. 27), many studies have found a statistical association between gender, location, and education variables, with female, urban, and bachelor degree-educated (or higher) respondents associated with “more positive attitudes towards Aboriginal issues in general.” We found mixed results on these variables (additional modeling results available on request). However, we found that those who considered themselves closely associated with environmental groups were more likely to support reallocation, and this was consistent across the models. Once we introduced an information treatment, the cost of reallocation is unimportant, but low-income households as a group are less likely to vote Yes.

In our study, those respondents who were willing to pay to reallocate water to Aboriginal communities did not indicate overwhelming support for a particular use—environmental and cultural versus agricultural businesses. However, provision of information did shift preferences. It affected responses such that more

people expressed a preference for nonconsumptive (environmental and cultural) uses than consumptive use (agricultural businesses). That the public might not hold very strong views about how Aboriginal people should use their water allocations will be of interest to those Aboriginal nations seeking public support to determine their own water choices (Taylor et al., 2017). It should also be of interest to policy makers and the irrigation sector, which in 2015, succeeded in limiting the amount of water that the federal government can purchase for the environment. Under current legislation, restoring more water to the environment is to be achieved by irrigation efficiencies and not through government purchases of irrigation entitlements (Grafton, 2019; Grafton & Wheeler, 2018). This policy change is a potential barrier to the development of a large-scale buyback program to satisfy Indigenous peoples' claims for water, should they choose to direct it to the environment.

The WTP results differed across the jurisdictions; see Table 4 Condition 3. Reasons for these differences are unknown. It might be that estimates were highest in NSW and Victoria, as these states have a longer history of working with Aboriginal communities on water issues, whereas in South Australia, where estimates were lowest, the environmental watering agenda is prominent (Robinson et al., 2014) and respondents may perceive Aboriginal control of water to be a risk to that objective. Queensland is a very large state, most of which is outside the basin, and it could be that this, combined with the recent drought in the northern basin, explains lower WTP estimates.

Regardless of the differences in the WTP estimates, our survey serves to engage the wider public in ongoing water policy debates and provides an indication of the support that exists for the principle of reallocating water rights. Aggregate WTP estimates are often used in decision-support tools, such as cost-benefit analysis (Boyle, 2017), as they allow societal benefits to be considered alongside financial costs. However, there are some limitations to our WTP estimates. First, there is potential for coverage bias associated with online surveys, nonresponse bias, and aggregation bias. Second, the topic of reallocating water rights to Aboriginal people is a new one in Australian water policy and a questionnaire like this places a cognitive burden on respondents. Deliberative approaches to valuation that provide more information and opportunities to engage in discussion may address this shortcoming (see Kenter et al., 2016). We would expect that more information about the historical use and regulation of waterways by Aboriginal people could increase WTP for reallocating entitlements. Knowledge of Aboriginal management of inland waters for fisheries, as documented by Barber and Jackson (2014) in the Northern Territory and McNiven and Bell (2010) in Victoria, or for plant production throughout Australia (Pascoe, 2014), could be helpful in this regard.

The third consideration is of a different kind for it relates to the philosophical basis of economic theory and the psychological model of decision-making (Spash et al., 2009; Ryan & Spash, 2011) that underpin valuation methods, as well as economic conceptualizations of water values. Spash et al. (2009) explain that economics assumes a preference utilitarian philosophy where cost and benefits to a household or government determine whether an action should be undertaken from a social welfare point of view. The associated psychological model assumes a narrow self-interest that brackets the role of attitudes and social norms. It is from these assumptions that economic methods construe individuals as able and willing to consider trade-offs in relation to the quantity and/or quality of public goods, such as water. A common philosophical alternative to the utilitarian motivation is rights based and, according to Spash et al. (2009), it is from this philosophical standpoint that ethicists argue individuals may refuse to make trade-offs, especially when asked how the environment should be treated.

The survey reported on here was developed and deployed in a policy context in which the market-oriented approach to water values is ascendant, if not dominant. Such a paradigm stresses individualistic relations with water (mediated through property rights) and economic success in those relations that are premised on "acceptable" trade-offs with ecological damage (Schmidt & Mitchell, 2014, p. 55). In a number of significant ways, the survey reflects aspects of this mode of water governance. Even though we were interested in attitudes toward the satisfaction or redress of Indigenous communal claims to water, some but not all questions in the survey were directed at individuals who we positioned as water consumers with a capacity, if not WTP. In addition, the mechanism we proposed for redress or reallocation was a market-based one (i.e., buy-backs), and part of the survey sought to test the acceptability of certain costs to individual respondents directly, through water charges, or indirectly, as taxpayers who would meet the cost of government

purchases of water for Aboriginal peoples' benefit. That said, as discussed above, in two conditions (1 and 4), we asked people to indicate their support with no costs attached.

It is possible that when asked to consider their WTP, some respondents might consider that Aboriginal people have an inherent right to water that should be recognized by the state, as the entity responsible for generating historical inequities. From such a position respondents might support reallocation through a legal but not market mechanism. There may be individuals who hold a philosophical position which is inconsistent with monetary valuation, or indeed the commodification of water, as a means of redressing injustice. Some of these respondents may refuse to cooperate with a stated preference survey like this (Spash et al., 2009) or alternatively bid Yes to any amount (lexicographic preferences; Spash et al., 2009; see also Ryan & Spash, 2011). It is worth reiterating that the water market is the only means by which water rights can be transferred between users and uses in this case study area.

In the current policy context there is no estimate of societal benefit from reallocation of water to Aboriginal people against which to benchmark our results; however, we can compare the aggregate WTP obtained in this study to the recent commitments by governments to address this water allocation challenge. In 2018, the federal government committed A\$40 million to enable Aboriginal communities to buy water entitlements over a 4-year period, and separately the Victorian state government set aside A\$5 million to develop a strategy to afford Aboriginal people greater access to water for economic development. For over a decade, Aboriginal organizations have advocated for market-based mechanisms to settle outstanding water rights issues (McAvoy, 2008), having found many obstacles to the application of legal frameworks such as native title (O'Bryan, 2019; Tan & Jackson, 2013). In 2002, for example, Aboriginal representative organizations in NSW advanced a proposal for an Aboriginal Water Trust. In that model, proponents anticipated that a levy on water sales would accumulate to deliver a fund of A\$250 million to hold water entitlements. However, the NSW state government refused to establish a means by which Aboriginal people could accumulate water rights (McAvoy, 2008). Many years later, government support has grown, although the quantum is modest when compared to the overall value of MDB water entitlements, which in 2015–2016 was approximately A\$16.5 billion (ABARES, 2016). Our conservatively derived aggregate value estimate of A\$74.5 million suggests that governments would find support from the public for an increase in the funds they intend to make available to improve Aboriginal access to water.

6. Conclusion

This paper contributes to the research on equity in water governance by providing an empirical analysis of public attitudes and values to reallocating water between groups who differ in resources, assets and political influence. We estimated, for the first time, the level of support and nonmarket value of reallocating water in the MDB from irrigators to Aboriginal people. The results provide evidence on how the residents of basin jurisdictions would wish to see water allocation decisions justly dealt with, insights into preferences for allocations between consumptive and nonconsumptive uses, WTP estimates that differ by state, and the appeal of Indigenous voices in communicating values and benefits. The results indicate a firm level of support for the use of a market mechanism to obtain a fairer distribution of water, with the proportion of respondents supporting government buybacks exceeding the proportion willing to pay themselves.

Overall levels of support for reallocation in our context suggest that there is a reasonable prospect that a considerable number of Australians would endorse Aboriginal advocacy for policy mechanisms to buy and hold water for Aboriginal uses, irrespective of the purpose to which such water is directed. Nonetheless, those inclined toward reallocation to Aboriginal groups are more likely to define themselves as closely associated with environmental groups. Moreover, the results suggest that the benefit derived would be in excess of the sum the Australian government has committed to support investment by basin Aboriginal communities in cultural and economic water entitlements by almost a factor of 2. The results have practical value for policy makers, researchers, and Indigenous communities for benchmarking, tracking changes over time, and for advocacy within Australia and beyond.

Water allocation is an urgent global issue, and international authorities place a high value on the design of robust water allocation regimes (OECD, 2015). One measure of well-performing allocation regimes advanced by the Organisation for Economic Co-operation and Development is that they can deal with new water users and can increase and make more flexible, existing entitlements. Indigenous peoples are

clearly not new users; rather in some cases state systems of allocation have relatively recently come to recognize and act on their outstanding claims for water (Jackson, 2018b). To do so may require that others forego water, incurring a cost for governments and others. Better understanding public attitudes and values can support water reform directed toward social equity and restorative justice.

Acknowledgments

A grant from the Australian Research Council's Future Fellowships Program (project FT130101145) supported this research. Rosalind Bark received funding from the Distinguished Visitor Award, University of Tasmania. We are grateful to Geoff Syme and Mark Morrison for providing comments on early drafts of the survey and to Mark Tocock who assisted with data analysis. We thank the anonymous reviewers for the comments and suggestions. Data can be accessed via the Australian Data Archive (<https://ada.edu.au/>) under the project title "Australian Indigenous water reallocation survey."

References

- ABARES (2016). Australian water markets report 2015–16. Canberra: Australian Bureau of Agricultural and Resource Economics, <http://www.agriculture.gov.au/abares/research-topics/water/aust-water-markets-reports/awmr-2015-16/national-overview#entitlement-markets>, accessed 12 November 2018.
- ABS (2018a). 6227.0—Education and work, Australia, May 2018. Canberra: Australian Bureau of Statistics, <http://www.abs.gov.au/auststats/abs@nsf/0/556A439CD3D7E8A8CA257242007B3F32?OpenDocument>
- ABS (2018b). 6523.0—Household income and wealth, Australia, 2015–16 <http://www.abs.gov.au/AUSSTATS/abs@nsf/DetailsPage/6523.02015-16?OpenDocument>, accessed 9 November 2018.
- Alexandra, J. (2018). Evolving governance and contested water reforms in Australia's Murray Darling Basin. *Water*, 10(2), 113. <https://doi.org/10.3390/w10020113>
- Argent, R. M. (2017). Australia: State of the Environment 2016. Inland water. Report to the Department of Environment and Energy, Canberra. <https://soe.environment.gov.au/sites/g/files/net806/t/soe2016-inlandwater-final-web-v2.pdf?v=1495087097>, Accessed 11 July 2019.
- Arthur, B. (2010). *The Murray–Darling Basin regional and basin plans: Indigenous water and land data*. Canberra: Murray Darling Basin Authority.
- Australian Institute of Health and Welfare (2017). Australia's welfare 2017: In brief. Cat. no. AUS 215. Canberra: AIHW.
- Barber, M., & Jackson, S. (2014). Autonomy and the intercultural: Historical interpretations of Australian aboriginal water management in the Roper River catchment, Northern Territory. *Journal of the Royal Anthropological Institute*, 20(4), 670–693. <https://doi.org/10.1111/1467-9655.12129>
- Bark, R., Barber, M., Jackson, S., McLean, K., Pollino, C. A., & Moggridge, B. (2015). Operationalising the ecosystem services approach in water planning: A case study of indigenous cultural values from the Murray–Darling Basin, Australia. *International Journal of Biodiversity Science, Ecosystem Services & Management*, 11(3), 239–249. <https://doi.org/10.1080/21513732.2014.983549>
- Bark, R., Garrick, D., Robinson, C., & Jackson, S. (2012). Adaptive basin governance and the prospects for meeting Indigenous water claims. *Environmental Science & Policy*, 19–20, 169–177.
- Bark, R., Kirby, M., Connor, J., & Crossman, N. (2014). Water allocation reform to meet environmental uses while sustaining irrigation: A case study of the Murray–Darling Basin. *Australia Water Policy*, 16(4), 739–754. <https://doi.org/10.2166/wp.2014.128>
- Berry, K., & Jackson, S. (2018). The making of white water citizens in Australia and the US: Racialization as a transnational project of irrigation governance. *Annals of the Association of American Geographers*, 108(5), 1354–1369. <https://doi.org/10.1080/24694452.2017.1420463>
- Berry, K., Jackson, S., Cohen, T., & Matsui, K. (2017). Indigenous water histories II: Water histories and the cultural politics of water for contemporary Indigenous groups. *Water History*, 9(1), 1–7. <https://doi.org/10.1007/s12685-017-0195-0>
- Bjornlund, H., Xu, W., & Wheeler, S. (2014). An overview of water sharing and participation issues for irrigators and their communities in Alberta: Implications for water policy. *Agricultural Water Management*, 145, 171–180. <https://doi.org/10.1016/j.agwat.2013.09.020>
- Blamey, R., Bennett, J., & Morrison, M. (1999). Yea-saying in contingent valuation surveys. *Land Economics*, 75(1), 126–141. <https://doi.org/10.2307/3146997>
- Boyle, K. J. (2017). Contingent valuation in practice. In P. A. Champ, K. J. Boyle, & T. C. Brown (Eds.), *A primer in nonmarket valuation*, (second ed., pp. 83–131). Dordrecht, The Netherlands: Springer. https://doi.org/10.1007/978-94-007-7104-8_4
- Budd, J. (2009). The 1981 water code: The impacts of private tradeable water rights on peasant and indigenous communities in northern Chile. In W. L. Alexander (Ed.), *Lost in the long transition: Struggles for social justice in neoliberal Chile* (pp. 41–54). Lanham: Lexington Books.
- Clayton, S. (2000). Models of environmental justice. *Journal of Social Issues*, 56, 457–474.
- Colby, B. G., McGinnis, M. A., & Rait, K. A. (1991). Mitigating environmental externalities through voluntary and involuntary water reallocation: Nevada's Truckee–Carson River Basin. *Natural Resources Journal*, 31(4/3), 757–783.
- Conca, K., & Weinthal, E. (2018). *The Oxford handbook of water politics and policy*. Oxford: Oxford University Press.
- Cosgrove, W. J., & Loucks, D. P. (2015). Water management: Current and future challenges and research directions. *Water Resources Research*, 51, 4823–4839. <https://doi.org/10.1002/2014WR016869>
- Cullet, P. (2018). Innovation and trends in water law. In E. Conca, & E. Weinthal (Eds.), *The Oxford handbook of water politics and policy*, (pp. 327–350). Oxford: Oxford University Press.
- Durette, M. (2010). A comparative approach to indigenous legal rights to freshwater: Key lessons for Australia from the United States, Canada and New Zealand. *Environmental and Planning Law Journal*, 27(4), 296–315.
- Forrest, J., & Dunn, K. (2006). Racism and intolerance in Eastern Australia: A geographic perspective. *Australian Geographer*, 37(2), 167–186. <https://doi.org/10.1080/00049180600711082>
- Grafton, R. Q. (2019). Policy review of water reform in the Murray–Darling Basin, Australia: The “do's” and “do not's”. *Australian Journal of Agricultural and Resource Economics*, 63(1), 116–141. <https://doi.org/10.1111/1467-8489.12288>
- Grafton, R. Q., & Horne, J. (2014). Water markets in the Murray–Darling Basin. *Agricultural Water Management*, 145, 61–71. <https://doi.org/10.1016/j.agwat.2013.12.001>
- Grafton, R. Q., & Wheeler, S. (2018). Economics of water recovery in the Murray–Darling Basin, Australia. *Annual Review of Resource Economics*, 10, 3.1–3.24.
- Graham, S. (2009). Irrigators' attitudes towards environmental flows for wetlands in the Murrumbidgee, Australia. *Wetlands Ecology and Management*, 17(4), 303–316. <https://doi.org/10.1007/s11273-008-9108-4>
- Griffiths, B., & Pederson, A. (2009). Prejudice and the function of attitudes relating to Muslim Australians and indigenous Australians. *Australian Journal of Psychology*, 61(4), 228–238. <https://doi.org/10.1080/00049530902748275>
- Haab, T. C., & McConnell, K. E. (2002). *Valuing environmental and natural resources*. Cheltenham: Edward Elgar Publishing. <https://doi.org/10.4337/9781843765431>

- Hadjigeorgalis, E. (2008). Distributional impacts of water markets on small farmers: Is there a safety net. *Water Resources Research*, 44, W10416. <https://doi.org/10.1029/2007WR006527>
- Jackson, S. (2017). How much water does a culture need? Environmental water management's cultural challenge and indigenous responses. In A. Horne, A. Webb, M. Stewardson, B. Richter, & M. Acreman (Eds.), *Water for the environment*, (pp. 173–188). London: Elsevier. <https://doi.org/10.1016/B978-0-12-803907-6.00009-7>
- Jackson, S. (2018a). Indigenous peoples and water justice in a globalizing world. In K. Conca, & E. Weinthal (Eds.), *Oxford handbook on water politics and policy*, (pp. 120–141). Oxford: Oxford University Press.
- Jackson, S. (2018b). Water and indigenous rights: Mechanisms and pathways for recognition, representation, and redistribution. *WIREs Water*, 5(6).
- Jackson, S., & Langton, M. (2012). Trends in the recognition of indigenous water needs in Australian water reform: The limitations of 'cultural' entitlements in achieving water equity. *Journal of Water Law*, 22(2/3), 109–123.
- Kenter, J. O., Jobstvogt, N., Watson, V., Irvine, K. N., Christie, M., & Bryce, R. (2016). The impact of information, value-deliberation and group-based decision-making on values for ecosystem services: Integrating deliberative monetary valuation and storytelling. *Ecosystem Services*, 21, 270–290. <https://doi.org/10.1016/j.ecoser.2016.06.006>
- Loch, A., Wheeler, S., Boxall, P., Hatton-Macdonald, D., Adamowicz, W., & Bjornlund, H. (2014). Irrigator preferences for water recovery budget expenditure in the Murray-Darling Basin, Australia. *Land Use Policy*, 36, 396–404. <https://doi.org/10.1016/j.landusepol.2013.09.007>
- Lukasiewicz, A., Bowmer, K., Syme, G., & Davidson, P. (2013). Assessing government intentions for Australian water reform using a social justice framework. *Society & Natural Resources*, 26(11), 1314–1329. <https://doi.org/10.1080/08941920.2013.791903>
- Macpherson, E. (2017). Beyond recognition: Lessons from Chile for allocating indigenous water rights in Australia. *UNSW Law Journal*, 40, 1130–1169.
- McAvoy, T. (2008). The human right to water and aboriginal water rights in New South Wales. *Human Rights Defender*, 17(1), 6–9.
- McNiven, I., & Bell, D. (2010). Fishers and farmers: Historicising the Gunditjmarra freshwater fishery, Western Victoria. *The La Trobe Journal*, 85, 83–95.
- Morrison, M. (2000). Aggregation biases in stated preference studies. *Australian Economic Papers*, 39(2), 215–230. <https://doi.org/10.1111/1467-8454.00087>
- Morrison, M., & Hill, C. M. (2017). Understanding the non-market value and equity implications of the Walsh Bay Arts Precinct redevelopment. *The Economic Record*, 93(301), 302–313. <https://doi.org/10.1111/1475-4932.12317>
- Mueller, J. M., Soder, A. B., & Springer, A. E. (2019). Valuing attributes of forest restoration in a semi-arid watershed. *Landscape and Urban Planning*, 184, 78–87. <https://doi.org/10.1016/j.landurbplan.2018.12.012>
- Neal, M., Lukasiewicz, A., & Syme, G. (2014). Why justice matters in water governance: Some ideas for a 'water justice framework'. *Water Policy*, 16(S2), 1–18. <https://doi.org/10.2166/wp.2014.109>
- Nikolakis, W., Grafton, R., & Hang, T. (2013). Indigenous values and water markets: Survey insights from northern Australia. *Journal of Hydrology*, 500, 12–20. <https://doi.org/10.1016/j.jhydrol.2013.07.016>
- O'Bryan, K. (2019). *Indigenous rights and water resource management: Not just another stakeholder*. Bosa Roca: Routledge. <https://doi.org/10.4324/9781351239820>
- OECD (2015). *Water resources allocation: Sharing risks and opportunities*, OECD Studies on Water. Paris: OECD Publishing. <https://doi.org/10.1787/9789264229631-en>
- Pascoe, B. (2014). *Dark emu: Dark seeds, agriculture or accident*. Broome: Magabala Books.
- Peate, V. G., Platow, M. J., & Eggins, R. A. (2008). Collective voice and support for social protest among Indigenous and non-Indigenous Australians: Considering the role of procedural fairness in an intergroup conflict of interest. *Australian Journal of Psychology*, 60, 175–185.
- Pederson, A., Clarke, S., Dudgeon, P., & Griffiths, B. (2005). Attitudes toward indigenous Australians and asylum seekers: The role of false beliefs and other social-psychological variables. *Australian Psychologist*, 40(3), 170–178. <https://doi.org/10.1080/00050060500243483>
- Productivity Commission (2018). *Murray Darling Basin plan: Five year assessment, draft report*. Canberra: Australian Government.
- Raymond, C., Bryan, B., Hatton Macdonald, D., Cast, A., Strathearn, S., Grandgirard, A., & Kalivas, T. (2009). Mapping community values for natural capital and ecosystem services. *Ecological Economics*, 68(5), 1301–1315. <https://doi.org/10.1016/j.ecolecon.2008.12.006>
- Robinson, C., Bark, R., Garrick, D., & Pollino, C. (2014). Sustaining local values through river basin governance: Community-based initiatives in Australia's Murray-Darling Basin. *Journal of Environmental Planning and Management*, 58(12), 2212–2227. <https://doi.org/10.1080/09640568.2014.976699>
- Robison, J., Cosens, B., Jackson, S., Leonard, K., & McCool, D. (2018). Indigenous water justice. *Lewis & Clark Law Review*, 22(3), 873–953.
- Ryan, A., & Spash, C. L. (2011). Is WTP an attitudinal measure?: Empirical analysis of the psychological explanation for contingent values. *Journal of Economic Psychology*, 32(5), 674–687. <https://doi.org/10.1016/j.joep.2011.07.004>
- Schmidt, J., & Mitchell, K. (2014). Property and the right to water: Toward a non-liberal commons. *Review of Radical Political Economics*, 46(1), 54–69. <https://doi.org/10.1177/0486613413488069>
- Schmidt, J., & Peppard, C. Z. (2014). Water ethics on a human-dominated planet: Rationality, context and values in global governance. *Wiley Interdisciplinary Reviews Water*, 1(6), 533–547. <https://doi.org/10.1002/wat2.1043>
- Spash, C., Urama, K., Burton, R., Kenyon, W., Shannon, P., & Hill, G. (2009). Motives behind willingness to pay for improving biodiversity in a water ecosystem: Economics, ethics and social psychology. *Ecological Economics*, 68(4), 955–964. <https://doi.org/10.1016/j.ecolecon.2006.09.013>
- Syme, G., Nancarrow, B., & McCreddin, J. (1999). Defining the components of fairness in the allocation of water to environmental and human uses. *Journal of Environmental Management*, 57(1), 51–70. <https://doi.org/10.1006/jema.1999.0282>
- Syme, M., & Nancarrow, B. (1996). Planning attitudes, lay philosophies, and water allocation: A preliminary analysis and research agenda. *Water Resources Research*, 32(6), 1843–1850. <https://doi.org/10.1029/96WR00465>
- Tan, P., & Jackson, S. (2013). Impossible dreaming—Does Australia's water law and policy fulfil indigenous aspirations? *Environment and Planning Law Journal*, 30, 132–149.
- Tarlock, A. (2010). Tribal justice and property rights: The evolution of Winters vs. United States. *Natural Resources Journal*, 50, 471–499.
- Taylor, S., Moggridge, B., & Poelina, A. (2017). Australian indigenous water policy and the impacts of the ever-changing political cycle. *Australian Journal of Water Resources*, 20, 132–147.
- The Australian Psychological Society (1997). Race and racism: Psychological perspectives, position paper, September 1997, <https://www.psychology.org.au/getmedia/e3ee1f94-9b79-4e4a-98e8-e57e26f9c0e2/Racism-and-prejudice.pdf> [accessed 20 October 2018]

- Thorvaldson, J., Pritchett, J., & Goemans, C. (2010). Western households' water knowledge, preferences, and willingness to pay. *Canadian Journal of Agricultural Economics*, 58, 497–514.
- Trawick, P. (2003). Against the privatization of water: An indigenous model for improving existing laws and successfully governing the commons. *World Development*, 31, 977–996.
- UN General Assembly (2007). United Nations declaration on the rights of indigenous peoples: Resolution adopted by the General Assembly, 2 October 2007, A/RES/61/295, available at <http://www.refworld.org/docid/471355a82.html> [accessed 5 May 2019]
- Van Koppen, B., & Schreiner, B. (2014). Priority general authorisations in rights-based water use authorisation in South Africa. *Water Policy*, 16(S2), 59–77. <https://doi.org/10.2166/wp.2014.110>
- Venn, T., & Quiggan, J. (2007). Accommodating indigenous cultural heritage values in resource assessment: Cape York Peninsula and the Murray–Darling Basin, Australia. *Ecological Economics*, 61(2–3), 334–344. <https://doi.org/10.1016/j.ecolecon.2006.03.003>
- Walter, M. (2012). Keeping our distance: Non-indigenous/aboriginal relations in Australian society. In J. Pietsch, & H. Aarons (Eds.), *Australia: Identity, Fear and Governance in the 21st Century*, (pp. 15–31). Canberra: ANU Press.
- Weir, J. (2009). *Murray River country: An ecological dialogue with traditional owners*. Canberra: Aboriginal Studies Press.
- Wentworth Group of Concerned Scientists (2017). Review of water reform in the Murray Darling Basin. <http://wentworthgroup.org/wp-content/uploads/2017/11/Wentworth-Group-Review-of-water-reform-in-MDB-Nov-2017.pdf>, accessed 16 December 2018.
- Wheeler, S., Hatton Macdonald, D., & Boxall, R. (2017). Water policy debate in Australia: Understanding the tenets of stakeholders' social trust. *Land Use Policy*, 63, 246–254. <https://doi.org/10.1016/j.landusepol.2017.01.035>
- Wheeler, S., Zuo, A., & Bjornlund, H. (2013). Australian irrigators' recognition of the need for more environmental water flows and intentions to donate water allocations. *Journal of Environmental Planning and Management*, 57(1), 104–122.
- Wheeler, S., Zuo, A., & Bjornlund, H. (2014). Investigating the delayed on-farm consequences of selling water entitlements in the Murray–Darling Basin. *Agricultural Water Management*, 145, 72–82.
- Whiteley, J., Ingram, H., & Perry, R. (2008). *Water, place, and equity*. Michigan: The MIT Press. <https://doi.org/10.7551/mitpress/9780262232715.001.0001>
- Wilder, M., & Ingram, H. (2018). Knowing equity when we see it: Water equity in contemporary global contexts. In E. Conca, & E. Weinthal (Eds.), *The Oxford handbook of water politics and Policy*, (pp. 49–75). Oxford: Oxford University Press.
- Wittwer, G. (2011). Confusing policy and catastrophe: Buybacks and drought in the Murray–Darling Basin. *Economic Papers*, 30(3), 289–295. <https://doi.org/10.1111/j.1759-3441.2011.00122.x>
- Wittwer, G., & Griffith, M. (2011). Modelling drought and recovery in the southern Murray–Darling basin. *Australian Journal of Agricultural and Resource Economics*, 55(3), 342–359. <https://doi.org/10.1111/j.1467-8489.2011.00541.x>
- Womble, P., Perrone, D., Jasechko, S., Nelson, R., Szeptycki, L., Anderson, R., & Gorelick, S. (2018). Indigenous communities, groundwater opportunities. *Science*, 361(641), 454–455.
- Wutich, A., Brewis, A., York, A., & Stotts, R. (2013). Rules, norms, and injustice: A cross-cultural study of perceptions of justice in water institutions. *Society and Natural Resources*, 26(7), 795–809. <https://doi.org/10.1080/08941920.2012.723302>
- Zander, K. (2013). Understanding public support for indigenous natural resource management in Northern Australia. *Society & Natural Resources*, 18, 11.
- Zander, K. K., Garnett, S., & Straton, A. (2010). Trade-offs between development, culture and conservation: Willingness to pay for tropical river management among urban Australians. *Journal of Environmental Management*, 91, 519–2528.
- Zander, K. K., & Garnett, S. T. (2011). The economic value of environmental services on Indigenous-held lands in Australia. *PLoS ONE*, 6(8), e23154. <https://doi.org/10.1371/journal.pone.0023154>
- Zwarteveen, M., & Boelens, R. (2014). Defining, researching and struggling for water justice: Some conceptual building blocks for research and action. *Water International*, 39(2), 143–158. <https://doi.org/10.1080/02508060.2014.891168>